

A STUDY OF SOME NORTH AMERICAN MOTHS
ALLIED TO THE THYATIRID GENUS
BOMBYCIA HÜBNER

By J. F. GATES CLARKE and FOSTER H. BENJAMIN¹

Of the Bureau of Entomology and Plant Quarantine,
United States Department of Agriculture

The present paper was begun by Foster H. Benjamin, but his uncompleted manuscript, which was being written to precede Dr. W. T. M. Forbes' paper on the Thyatiridae (1936),² was only recently discovered.

In his manuscript Benjamin had described as new the genus *Bycambia* and the species *Bombycia semifasciata* and *Bombycia crumbi* (herein placed in the new genus *Ceranemota*). The new genus *Bycambia* and the two new species mentioned above must be credited to him. In addition I have described one new genus and three new species.

Forbes discussed the genera of this family and clearly showed the differences between them. He preferred, however, to consider *Bombycia* in the broad sense and included in it the North American species herein referred to *Ceranemota*. *Bombycia*, however, should be restricted to *or* D. and S., and its congeners. In this same paper Forbes also mentioned *B. verdugoensis* Hill, stating that it belonged in the *Bombycia* complex but that he had not studied it critically. His statement was, I believe, made with full knowledge of the facts but in anticipation of the publication of Benjamin's proposed paper and in courtesy to him.

The present paper is based on a study of specimens in the collection of the United States National Museum.

The drawings were made under my supervision by Mrs. Eleanor A. Carlin of the Bureau of Entomology and Plant Quarantine.

J. F. G. C.

The following keys will serve to separate *Bombycia*, *Bycambia* and *Ceranemota*.

¹ Deceased.

² Forbes, W. T. M., Ann. Ent. Soc. Amer., vol. 29, pp. 779-803, 1936.

Key Based on External Characters

1. Frontal tuft of head present 2
 Frontal tuft of head absent *Bombycia*
2. Fore wing with accessory cell *Ceranemota*
 Fore wing without accessory cell *Bycambia*

Keys Based on Genitalic Characters

Males

1. Uncus simple *Bombycia*
 Uncus divided 2
2. Clasper present *Ceranemota*
 Clasper absent *Bycambia*

Females

1. Ductus bursae membranous 2
 Ductus bursae strongly sclerotized, at least for part of
 its length *Ceranemota*
2. Ductus seminalis with sclerotized band at base *Bycambia*
 Ductus seminalis without sclerotized band at base *Bombycia*

CERANEMOTA Clarke, new genus

Genotype: *Bombycia improvisa* (Hy. Edwards).

Antenna with basal scale tuft; segments of male antenna strongly ciliate, each with a carinate process beneath, the processes smaller on the basal and terminal segments in proportion to the tapering of the antenna. Antenna of female similar but pubescent rather than ciliate and the processes of the segments smaller. Proboscis present, with saw-like tip. Palpus moderately long; first and second segments clothed with much long hair beneath; third segment porrect, about two-thirds the length of second, clothed with scales. Gena narrow, lunate. Frons tufted with hair-like scales; occiput strongly tufted with hair and thin bifurcate scales; eye rather large, round, naked, strongly lashed.

Thorax clothed with hair and furcate scales; collar divided, the furcations joining the tegulae to form two erect crests; metathorax hairy but not strongly tufted. Abdomen untufted and clothed mainly with scales; first to third segments slightly hairy above.

Fore wing moderately broad, termen evenly curved; 12 veins; vein 3 from near angle of cell, approximate to 4 at base; 5 weak, from middle of discocellulars; 6 connate with the stalk of 7 and 8; stalk of 7 and 8 fusing with 9, beyond the stalk of 9 and 10, to form accessory cell; 10 reaching costa; 11 from well beyond middle of cell.

Hind wing with apex rounded; veins 3 and 4 closely approximate; 5 weak, from slightly below middle of discocellulars; 6 straight from upper angle of cell; 7 from well before angle, 7 and 8 closely approximate to slightly beyond origin of 7.

Male genitalia: Symmetrical. Harpe strongly sclerotized in basal half, less strongly so in distal half; clasper formed by an extension of the sacculus. Uncus bifurcate, naked. Socii small, digitate. Aedeagus with terminal hook; vesica armed with patch of small cornuti. Vinculum broadly excavate.

Female genitalia: With ostium as broad as width of segment. Ductus seminalis from ventral surface of ductus bursae. Signum present, small, scobinate.

Ceranemota is closely allied to *Bycambia* and also to *Bombycia* and *Nemacerota*. It may be distinguished from *Bombycia* (*B. or D. & S.*, and its congeners) by the bifurcate uncus, well developed clasper, and reduced socii in the male and the strongly sclerotized ductus bursae in the female. *Nemacerota* lacks the uncus entirely and possesses greatly exaggerated socii. The characters by which *Bycambia* may be separated from *Ceranemota* will be found in the descriptions of the two genera.

Key to the Species of *Ceranemota*

Males

1. Aedeagus with a prominent, rounded ventral projection
(Figures 3a, 7a-9a) 2
- Aedeagus without such ventral projection (Figures 2a,
4a-6a) 5
2. Tegumen with dorsal prominence (Figure 8b) *partida*
Tegumen without dorsal prominence (Figure 9b) 3
3. Clasper short, narrowly pyramidal (Figure 7) *albertae*
Clasper not pyramidal (Figures 3, 9) 4
4. Clasper extending far beyond margin of harpe; ventral
margin of harpe evenly rounded (Figure 9) *tearlei*
Clasper extending short distance beyond edge of harpe;
ventral margin of harpe angulate (Figure 3) *semifasciata*
5. Tegumen without dorsal prominence 6
Tegumen with dorsal prominence (Figure 2b) *amplifascia*
6. Clasper large, attaining middle of harpe (Figure 6) *fasciata*
Clasper much smaller, never attaining middle of harpe
(Figures 4, 5) 7
7. Distal end of clasper pointed (Figure 4) *crumbi*
Distal end of clasper truncate (Figure 5) *improvvisa*

Females³

1. Ductus seminalis strongly sclerotized basally (Figures 10, 13, 15, 16) 2
Ductus seminalis membranous or only slightly sclerotized as base (Figure 14) *fasciata*
2. Anterior margin of ostium concave (Figures 10, 12, 13, 16) 3
Anterior margin of ostium V-shaped (Figures 11, 15) 6
3. Tergite of 8th segment nearly as broad as width of ductus bursae (Figures 12, 13) 4
Tergite of 8th segment narrow (Figures 10, 16) 5
4. Posterior edge of 8th tergite deeply concave; signum well developed (Figure 12) *partida*
Posterior edge of 8th tergite slightly concave; signum poorly developed (Figure 13) *albertae*
5. Anterior apophyses shorter than width of ductus bursae at middle (Figure 16) *crumbi*
Anterior apophyses longer than width of ductus bursae at middle (Figure 10) *improvisa*
6. Eighth tergite broad (Figure 11) *tearlei*
Eighth tergite narrow (Figure 15) *amplifascia*

CERANEMOTA IMPROVISA (Hy. Edwards), new combination

Plate 14, Figs. 5, 5a; Plate 16, Fig. 10; Plate 17, Figs. 17, 20

Cymatophora improvisa Hy. Edwards, Proc. Calif. Acad. Sci., vol. 5, p. 189, 1873.—Barnes and McDunnough, Check List of the Lepidoptera of Boreal America, No. 3696, 1917.—Blackmore, Check List of the Macrolepidoptera of British Columbia, p. 33, 1927.

Cymatophora or race *improvisa* (Hy. Edwards) Turner, Ent. Rec. (suppl.), vol. 38, p. 19, 1926.

Bombycia improvisa (Hy. Edwards) Grote, Can. Ent., vol. 6, p. 154, 1874; Bul. Buff. Soc. Nat. Sci., vol. 3, p. 78, 1875.—Stett. Ent. Zeit., vol. 37, p. 134, 1876; Papilio, vol. 1, p. 76, 1881.—Smith, List of the Lepidoptera of Boreal America, No. 1464, 1891; U. S. Nat. Mus. Bul. 44, p. 29, 1893.—Grote, Abhandl. Natur. Ver. Bremen, vol. 14, p. 10, 1895.—Dyar, List of North American Lepidoptera, No. 3184, 1903.—Smith, Check List of the Lepidoptera of Boreal America, No. 3332, 1903.—Anderson, Catalogue of British Columbia Lepidoptera, No. 698, 1904.—Barnes and McDunnough,

³I have not seen the female of *semifasciata*.

Journ. N. Y. Ent. Soc., vol. 18, p. 160, 1910.—Day, Proc. B. C. Ent. Soc., No. 1 (n.s.), p. 30-33, 1911.—Barnes and McDunnough, Cont. Lepid. N. Amer., vol. 4, pl. 12, fig. 4, 1912.

Male genitalia: Cucullus broad, rounded; clasper short, pyramidal, truncated. Anellus a broad rectangular plate, scobinate in posterior half and with a broad, deep median excavation; lateral lobes well developed. Aedeagus stout, without rounded ventral prominence; terminal hook long, sharply curved. Socii large, pointed. Uncus stout, prongs broad, narrowly separated.

Female genitalia: Tergite of 8th segment narrow with slightly concave posterior margin. Anterior margin of ostium concave. Posterior half of ductus bursae strongly sclerotized, especially so just before ostial opening. Basal portion of ductus seminalis two-thirds the width of the ductus bursae, strongly sclerotized. Signum a small, scobinate, elongate plate.

Alar expanse, 34-37 mm.

Type: In American Museum of Natural History.

Type locality: Cascades, Washington.

Food plant: Wild Cherry.

Distribution: United States—California: Male (no date or collector). Washington: Bellingham, male (1923, J. F. G. Clarke); Pullman, female (July, C. V. Piper); Seattle, male (O. B. Johnson). Canada—British Columbia: Duncan, 11 males, 7 females (October dates, A. W. Hanham); Victoria, 5 males, female (October dates).

Remarks: The female genitalia of *improvisa* are more nearly symmetrical than those of *crumbi* and have a narrower 8th tergite. The signum is more elongate and the anterior apophyses are nearly twice as long in *improvisa* as in *crumbi*. This and *crumbi* are very closely related. In the male genitalia of *improvisa* the vinculum is very broad with a deep excavation, in *crumbi* the vinculum is narrow with a broad shallow excavation. The socii are longer and more pointed and the aedeagus is shorter and stouter in *improvisa* than in *crumbi*.

CERANEMOTA FASCIATA (Barnes and McDunnough) (new combination)

Plate 14, Figs. 6, 6a; Plate 16, Fig. 14

Bombycia fasciata Barnes and McDunnough, Journ. N. Y. Ent. Soc., vol. 18, p. 160, 1910.—Day, Proc. B. C. Ent. Soc., No. 1 (n.s.), p. 30, 1911. — Barnes and McDunnough, Cont. Lepid. N. Amer., vol. 1, pl. 12, fig. 5, 1912.

Cymatophora fasciata Barnes and McDunnough, Check List of the Lepidoptera of Boreal America, No. 3698, 1917.

Cymatophora or race *fasciata* (Barnes and McDunnough) Turner, Ent. Rec. and Jour. Variation (suppl.), vol. 38, p. 19, 1926.

Male genitalia: Harpe broad, of about equal width throughout; cucullus broadly rounded; clasper large, pyramidal, pointed. Anellus a large rectangular plate scobinate on posterior half; lateral edge with concavity in posterior half; median incision deep, broad. Aedeagus without ventral rounded prominence; terminal hook long, pointed. Socii large, pointed. Prongs of uncus short, flat, separated by a small median excavation.

Female genitalia: Tergite of collar moderately broad and of nearly equal width throughout. Anterior edge of ostium evenly concave. Posterior third of ductus bursae strongly sclerotized. Basal portion of ductus seminalis only lightly sclerotized. Signum small but well developed.

Alar expanse, 37-42 mm.

Type: In United States National Museum, No. 52691.

Type locality: Duncan, Vancouver Island, British Columbia.

Food plant: *Prunus occidentalis* Swartz.

Distribution: United States—Washington: Mt. Rainier, male ("22-VII-1923", Geo. P. Engelhardt). Canada—British Columbia: Duncan, Vancouver Island, 10 males, 33 females (September and October dates, A. W. Hanham); Westminster, female (no date or collector).

Remarks: This species may be distinguished from all others described from North America by the unusually large pyramidal clasper in the male and the relatively small sclerotized portion of the ductus bursae of the female.

CERANEMOTA CRUMBI Benjamin, new species

Plate 14, Figs. 4, 4a; Plate 16, Fig. 16

A dark brown species near *improvisa* Hy. Edw. but lacking all of the pale gray and practically all of the green coloration of that species.

Labial palpus fuscous with white scales intermixed; apex of third segment white; front black, scales white-tipped; apical tuft of head dull rufous brown, the latter irrorated and suffused with black; tegula edged with black anteriorly and along inner margin; at middle of base of wing a prominent fuscous scale tuft followed by a few greenish-tinged white scales; costa narrowly, but distinctly, pink; transverse median fascia ill defined and indicated chiefly by the indistinct broad rufous transverse anterior and posterior lines; cilia fuscous with a narrow, crenulate, black basal line. Hindwing smoky fuscous, lighter basally; ciliar light

fuscous, lightly suffused with pink, with a distinct, narrow, fuscous basal line; fore and hind wings with golden sheen. Fore and mid legs fuscous annulated and irrorated with whitish ochreous; hind leg whitish ochreous irrorated with fuscous; all legs suffused with pink.

Male genitalia: Harpe evenly and gently tapered to the rounded cucullus; clasper short, stout, pointed, pyramidal. Anellus elongate, rectangular, finely scobinate in posterior two-thirds, deeply and narrowly incised from posterior edge; lateral, fleshy, hairy lobes prominent. Aedeagus without lateral rounded prominence; terminal hook rather long, slender. Socii short, roundly pointed. Uncus stout; prongs broad, short, with a shallow excavation between.

Female genitalia: Dorsal tergite of collar moderately broad, of even width throughout. Anterior margin of ostium deeply concave. Inception of ductus seminalis short, broad, strongly sclerotized. Signum a small, but well defined, round, scobinate plate.

Alar expanse, 35-37 mm.

Type: United States National Museum No. 52268.

Type locality: Paradise Valley, Mt. Rainier, Washington.

Food plant: *Pyrus occidentalis* S. Wats.

Remarks: Described from the male type and three male and three female paratypes from the type locality as follows: Female and three males ("9-24-30"); male ("9-19-30"); female (Aug. 7, 1930) all reared from larvae collected by S. E. Crumb.

CERANEMOTA SEMIFASCIATA Benjamin, new species

Plate 13, Figs. 3, 3a

Rufous colorations and fasciate pale transverse posterior and subterminal lines similar to those of *fasciata* B. & McD., but with the ground ashy gray as in *tearlei* Hy. Edw.

Antenna rufous with white scales sprinkled throughout; basal segment white. Labial palpus brownish fuscous irrorated with white; first segment with a distinct triangular white spot outwardly at apex; apex of third segment white. Head rufous with white laterally.

Thorax rufous; tegula gray; inner edge narrowly dark brown. Fore wing gray with a pale greenish dusting along costa; base of fore wing white with a small black spot near center; beyond this small black spot, and obliquely toward inner margin, a small tuft of black and white scales; transverse anterior and posterior lines broad rufous, the former preceded by a broad more or less indistinct fuscous shade, the latter followed by a narrower band of the same color; on costa, beyond the transverse posterior line,

four small fuscous spots, the two outer ones better defined than the two inner ones; at apex a well defined triangular whitish patch which narrows to form a distinct whitish subterminal line; before cilia a narrow, crenulate, black line; cilia light fuscous, white-tipped. Hind wing light yellowish fuscous, lighter basally; cilia fuscous at apex fading to whitish basally; subbasal line narrow, fuscous.

Fore and middle legs fuscous with creamy white annulations. Hind leg creamy white.

Male genitalia: Clasper of harpe short, pointed; margin of sacculus angulate; cucullus narrow, rounded. Anellus a rectangular plate, moderately sclerotized except for narrow central membranous portion; finely scobinate in posterior half; lateral edge near posterior end deeply concave. Aedeagus with large rounded ventral prominence; terminal hook short, stout. Socii somewhat compressed, bluntly pointed. Prongs of the uncus widely separated, much narrower than the excavation separating them. Tegumen without dorsal prominence.

Alar expanse, 35 mm.

Type: United States National Museum No. 52270.

Type locality: Siskiyou County, California (Koebele).

Remarks: Described from the unique male type. The genitalia of *semifasciata* are similar to those of *tearlei* Hy. Edw., but have a less strongly bifurcate uncus and smaller extension of the sacculus.

CERANEMOTA TEARLEI (Hy. Edwards) (new combination)

Plate 15, Figs. 9, 9b; Plate 16, Fig. 11

Gluphisia tearlei Hy. Edwards, Ent. Amer., vol. 2, p. 11, 1886.

Bombycia tearlei Hy. Edwards, Ent. Amer., vol. 4, p. 63, 1888.—
Grote, Abhand. Natur. Ver. Bremen, vol. 14, p. 10, 1895.

Bombycia tearlii (Hy. Edwards) Smith, List of the Lepidoptera of Boreal America, No. 1466, 1891; U. S. Nat. Mus. Bul. 44, p. 29, 1893; Check List of the Lepidoptera of Boreal America, No. 3333, 1903.—Wolley Dod, Can. Ent., vol. 38, p. 51, 1906.—Barnes and McDunnough, Cont. Lepid. N. Amer., vol. 1, pl. 12, fig. 19, 1912.

Cymatophora tearli Barnes & McDunnough, Check List of the Lepidoptera of Boreal America, No. 3697, 1917.—Blackmore, Check List of the Macrolepidoptera of British Columbia, p. 33, 1927.

Cymatophora or ab. race *tearlii* (Hy. Edwards) Turner, Ent. Rec. and Jour. Variation (suppl.), vol. 38, p. 19, 1926.

Male genitalia: Harpe narrow beyond clasper, cucullus bluntly pointed; clasper extending far beyond ventral margin. Anellus broad, roughly rectangular, postero-lateral edge deeply excavated; a deep V-shaped incision from posterior margin; in middle of anterior half a clear triangular area; almost entire sclerotized part scobinated. Aedeagus with a large, rounded ventral protuberance; terminal hook bluntly pointed. Socii small, pointed. Prongs of uncus long, relatively narrow, with a moderately broad, deep U-shaped excavation between. Tegumen without dorsal process.

Female genitalia: Ostium broadly V-shaped. Tergite of collar broad with postero-median concavity. Ductus bursae strongly sclerotized throughout most of its length; posteriorly narrowed before ostium; broadened and flattened anteriorly. Basal, sclerotized portion of ductus seminalis long, narrow. Signum weak, small.

Alar expanse, 35-40 mm.

Type: In American Museum of Natural History.

Type locality: Lake Tahoe, California.

Distribution: United States—California: Placer Co., 11 males, 8 females (September and October dates; Koebele and C. V. Riley); Santa Rosa, male (no date or collector); Sierra Nevada, male (no date or collector). Utah: Deer Creek, Provo Cañon, 4 males, 6 females ("8-11-IX-1918"; "1-X-1912", Tom Spalding); Eureka, male ("14-IX-1910", Tom Spalding). Canada—British Columbia: Marron Lake and Kaslo (acc. Blackmore).

Remarks: This species undoubtedly will be found in other western States, particularly in eastern Oregon and Washington.

Dyar⁴ and Holland⁵ both place this species as a synonym of *improvisa* Hy. Edwards.

I wish to thank Dr. A. B. Klots of the College of the City of New York for comparing slides of the genitalia of specimens in the National collection with those of the type.

CERANEMOTA PARTIDA, new species

Plate 15, Figs. 8, 8b; Plate 16, Fig. 12

This species is inseparable from *tearlei* in external characters but may be distinguished by characters of the genitalia.

Male genitalia: Harpe short; cucullus broadly rounded; clasper greatly exceeding ventral margin of harpe, pointed, with a short, triangular lateral projection near distal end. Anellus rectangular, moderately sclerotized; postero-lateral corners al-

⁴ Dyar, H. G., a List of North American Lepidoptera, No. 3184, 1903.

⁵ Holland, W. J., The Moth Book, p. 304. pl. 40, fig. 27, 1903.

most wholly membranous. Aedeagus stout, with well developed, rounded, ventral process; terminal hook broad, somewhat flattened. Socii small pointed. Uncus short, broad; prongs broad with a narrow horseshoe-shaped excavation between. Tegumen with dorsal prominence.

Female genitalia: Tergite of 8th segment broad; posterior edge deeply concave. Anterior margin of ostium concave. Ductus bursae broad, strongly sclerotized almost to bursa copulatrix. Inception of ductus seminalis narrow, strongly sclerotized, situated about half way between bursa copulatrix and ostium. Signum a small but well developed, sclerotized, scobinate plate.

Alar expanse, 36-41 mm.

Type: United States National Museum No. 52271.

Type locality: Glenwood Springs, Colorado (October 8-15).

Remarks: Described from the male type and one male and two female paratypes all from the same locality. The paratypes are as follows: Male (July 8-15); two females (September 16-23; September 24-30).

This species may be distinguished from *tearlei* by the broader vinculum, smaller lobes at the base of the harpe, more slender and more bluntly pointed clasper, shorter uncus and by the presence of a dorsal process of the tegumen. In the female of *partida* the posterior edge of the tergite of the 8th segment is more deeply concave, ductus bursae is broader and the signum is larger than in *tearlei*. In addition the inception of the ductus seminalis of *partida* is much farther forward than in *tearlei*.

CERANEMOTA ALBERTAE, new species

Plate 15, Figs. 7, 7a; Plate 16, Fig. 13

This species is much like *tearlei* and *partida* but is darker and more silvery. The cilia have a slight roseate tinge.

Male genitalia: Harpe narrow beyond clasper; cucullus rounded; clasper short pyramidal; lobes at base of sacculus small. Anellus roughly rectangular, slightly broader posteriorly than anteriorly, scobinate on posterior half; median posterior excavation deep, V-shaped. Aedeagus slender with large rounded ventral process; terminal hook thick, evenly curved. Socii rather long, pointed. Uncus broad, prongs narrow with a broad excavation between. Tegumen without dorsal prominence.

Female genitalia: Tergite of 8th segment moderately broad with slight concavity on posterior edge. Anterior margin of ostium concave. Ductus bursae broad, sclerotized for most of its length. Inception of ductus seminalis broad; sclerotized basal portion

almost reaching bursa copulatrix. Signum very weakly developed, small.

Alar expanse, 36-39 mm.

Type: United States National Museum No. 52269.

Type locality: Head of Pine Creek, Calgary, Alberta. ("I-IX-'03", F. H. Wooley Dod).

Remarks: Described from the male type and one male and one female paratypes all from the same locality. The paratypes are dated as follows: male (23-VIII-'97); female ("20-VIII-01").

The species of this group are all closely similar but may easily be distinguished by their genitalia. *Ceranemota albertae* may be distinguished from *C. tearlei* by the shorter clasper, the absence of a deep excavation between the clasper and cucullus, and the shorter ventral prominence of the aedeagus. The foregoing characters will serve also to distinguish *albertae* from *partida*. In addition *albertae* may be distinguished from *partida* by the absence of the dorsal prominence of the tegumen. The female genitalia likewise present good characters by which the three species may be distinguished. The 8th tergite of *albertae* is narrower than that of *tearlei* and lacks the deep concavity of *partida*. The small poorly developed signum will immediately distinguish *albertae* from the other two.

CERANEMOTA AMPLIFASCIA, new species

Plate 13, Figs. 2, 2b; Plate 16, Fig. 15

Antenna yellowish brown; dorsally and basally clothed with whitish-gray scales. Labial palpus gray; second segment strongly suffused with fuscous exteriorly; whitish inwardly; third segment with a broad incomplete median fuscous annulus; apex white.

Head, thorax, and ground color of fore wing ashy gray, mixed with fuscous and white scales. Collar yellowish brown; tegulae crested and narrowly edged inwardly with black. Fore wing with a broad, light median fascia and an area of the same shade before termen, both formed by the numerous overlying white scales; in cell a small fuscous spot; from apex inwardly to vein 7, then indistinctly to tornus, an irregular narrow dentate fuscous line; termed broadly grayish fuscous; t.a. and t.p. lines irregular, narrow brown, the former edged outwardly and the latter edged inwardly with black; at base of wing a small black spot and a small black and white scale tuft. Cilia grayish fuscous.

Hind wing light smoky; cilia concolorous with dark narrow basal line.

Fore leg gray; fore tibia with two blackish annulations; fore tarsus black annulated. Middle and hind legs whitish with a few light fuscous scales intermixed.

Abdomen gray with a faint yellowish cast above.

Male genitalia: Harpe clothed with fine hairs; cucullus narrowly rounded; clasper short, pyramidal, not extending beyond margin of the sacculus. Anellus a rectangular plate, scobinate on posterior half and deeply cleft to about middle; lateral hairy lobes well developed. Aedeagus without prominent lateral projection; terminal hook long, rather slender. Socii short, stout, blunt-pointed. Prongs of the uncus very broad; excavation between them narrow. Tegumen with dorsal process.

Female genitalia: Edge of ostium broadly V-shaped. Dorsal tergite of collar narrow. Ductus bursae sclerotized for two-thirds its length; strongly so in posterior third. Inception of ductus seminalis a strongly sclerotized ventral protuberance of the ductus bursae giving rise to the membranous portion of the duct. Signum a small, moderately sclerotized, scobinate plate.

Alar expanse, 37-41 mm.

Type: United States National Museum No. 52106.

Type locality: Placer County, California (October; Koebele).

Remarks: Described from male type and 2 male and 31 female paratypes all from California as follows: Male, Placer County (September; C. V. Riley); 1 male labeled only "California"; 22 females, Placer County (September and October; Koebele and C. V. Riley); 3 females, Truckee (September; Ximena McGlashan); 2 females, Sierra Nevada (no other data); 1 female, Nevada County (no other data).

This species is similar to *tearlei* Hy. Edw. but may be distinguished from that species by the generally broader transverse fascia of the fore wing, the broader prongs of the uncus, shorter clasper (which does not extend beyond margin of harpe), and the narrower 8th tergite in the female genitalia.

I am indebted to E. P. Van Duzee for a large part of the series from which this species was described.

BYCOMBIA Benjamin, new genus

Genotype: *Bombycia verdugoensis* Hill⁶ (Bul. So. Calif. Acad. Sci., vol. 26, p. 6, 1927).

Plate 13, Figs. 1, 1a; Plate 17, Figs. 18, 19, 21

Antennal segments of male ciliate, each with a carinate process beneath; the processes smaller on the terminal and basal segments in proportion to the tapering of the antenna. Antenna

⁶ Forbes, W. T. M., Ann. Ent. Soc. Amer., vol. 29, p. 784, 1936, incorrectly credits this species to Benjamin.

of female similar but with the processes only about half as long as those of the male. Proboscis present but very short, without sawlike tip. Palpus short, somewhat depressed, the second segment with much long hair and hairlike scales beneath; third segment porrect, nearly as long as second, clothed with long hair and hairlike scales. Gena broad, triangular. Frons tufted with long hair and hairlike scales, the vertex somewhat depressed; occiput with a strong tuft of these bifurcate scales, hairlike scales, and hair; eye small, somewhat narrow but not reniform; very heavily lashed, hairy, the hair very sparse, not long, confused and partly hidden by the lashes yet visible at 75 diameters' magnification.

Thorax clothed mainly with deeply furcate scales, appearing almost hairy; collar somewhat bifurcate, the furcations joining the tegulae to form two prominent ridges; metathorax with a strong furcate tuft. Abdomen untufted and only slightly hairy except for the dorsum of the first segment where the hair simulates a heavy scale tuft.

Fore wing narrow, the costal and hind margins subparallel, outer margin evenly curved; no accessory cell; 12 veins; vein 3 from near angle of cell, approximate to 4 at base; 5 weak, from middle of discocellulars; 6 out of the stalk of 7 and 8; 8 to apex; 9 and 10 stalked, approximate to stalk 6, 7, and 8; 10 not reaching costa.

Hind wing with apex slightly lobate; veins 3 and 4 connate or shortly stalked from lower angle of cell; 5 weak, nearer to 4 than to 6; 6 and 7 approximate; 7 and 8 closely approximate to beyond cell, then divergent.

Male genitalia: Harpe narrow, hairy, without clasper, caudal margin obliquely truncated, cucullus pointed; costa strongly but narrowly sclerotized; sacculus poorly defined, short, narrow, moderately sclerotized; as base of sacculus a fleshy papillum. Anellus a ring, broad and strongly sclerotized ventrally, narrow and membranous dorsally; ventrally, from posterior edge, a deep, narrow median incision. Aedeagus stout, thickest at middle, with a thick, pointed, slightly curved projection near proximal end; vesica armed with a large patch of small cornuti. Vinculum broad, convex. Socii present, near base of uncus, slender, digitate, hairy. Uncus broad with narrow neck, bifurcate, naked.

Female genitalia: Tergite of 8th segment broad, sclerotized. Ostium broad, deeply concave, anterior edge narrowly sclerotized. Ductus bursae membranous throughout. Ductus seminalis membranous except for a broad sclerotized band at inception. Signum present in the form of a narrow, scobinate, lunate plate.

Remarks: This genus is closely related to the foregoing. It contains only the genotype.

EXPLANATION OF PLATES

PLATE 13

- 1-1a. *Bycombia verdugoensis* (Hill). 1, lateral aspect of male genitalia with aedeagus removed; 1a, lateral view of aedeagus.
2-2b. *Ceranemota amplifascia*, new species. 2, ventral aspect of male genitalia with aedeagus removed; 2a, lateral view of aedeagus; 2b, dorsal view of tegumen showing dorsal process.
3-3a. *Ceranemota semifasciata*, new species. 3, ventral aspect of male genitalia with aedeagus removed; 3a, lateral view of aedeagus.

PLATE 14

- 4-4a. *Ceranemota crumbi*, new species. 4, ventral aspect of male genitalia with aedeagus removed; 4a, lateral view of aedeagus.
5-5a. *Ceranemota improvisa* (Hy. Edwards). 5, ventral aspect of male genitalia with aedeagus removed; 5a, lateral view of aedeagus.
6-6a. *Ceranemota fasciata* (Barnes and McDunnough). 6, ventral aspect of male genitalia with aedeagus removed; 6a, lateral view of aedeagus.

PLATE 15

- 7-7a. *Ceranemota albertae*, new species. 7, ventral aspect of male genitalia with aedeagus removed; 7a, lateral view of aedeagus.
8-8b. *Ceranemota partida*, new species. 8, ventral aspect of male genitalia with aedeagus removed; 8a, lateral view of aedeagus; 8b, dorsal view of tegumen showing dorsal process.
9-9b. *Ceranemota tearlei* (Hy. Edwards). 9, ventral aspect of male genitalia with aedeagus removed; 9a, lateral view of aedeagus; 9b, dorsal view of tegumen to show absence of dorsal process.

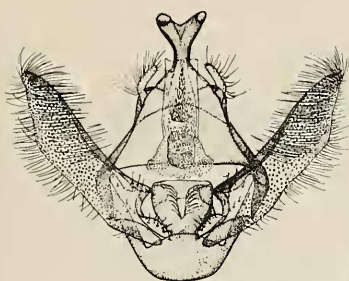
PLATE 16

Female genitalia: ventral view.

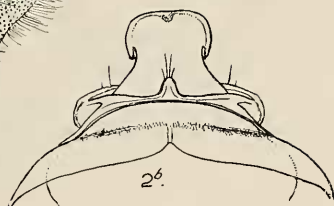
10. *Ceranemota improvisa* (Hy. Edwards).
11. *Ceranemota tearlei* (Hy. Edwards).
12. *Ceranemota partida*, new species.
13. *Ceranemota albertae*, new species.
14. *Ceranemota fasciata* (Barnes and McDunnough).
15. *Ceranemota amplifascia*, new species.
16. *Ceranemota crumbi*, new species.

PLATE 17

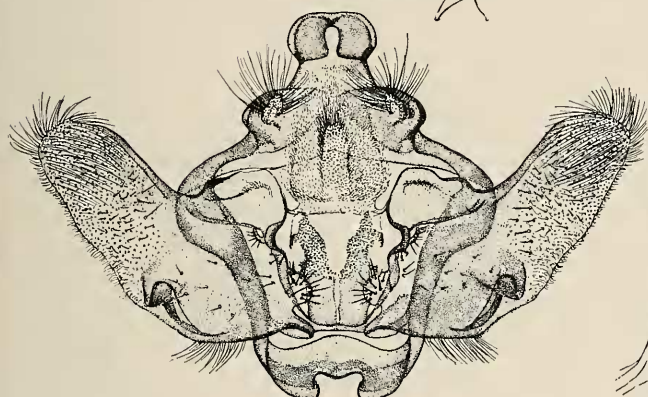
17. *Ceranemota improvisa* (Hy. Edwards): Wings.
18. *Bycombia verdugoensis* (Hill): Wings.
19. *Bycombia verdugoensis* (Hill): Ventral view of female genitalia.
20. *Ceranemota improvisa* (Hy. Edwards): Lateral aspect of head.
21. *Bycombia verdugoensis* (Hill): Lateral aspect of head.



1. *verdugoensis*



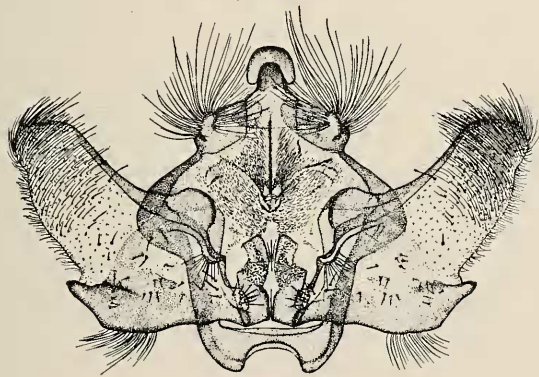
2^b



2 *amplifascia*



2^c



3. *semifasciata*



3^c

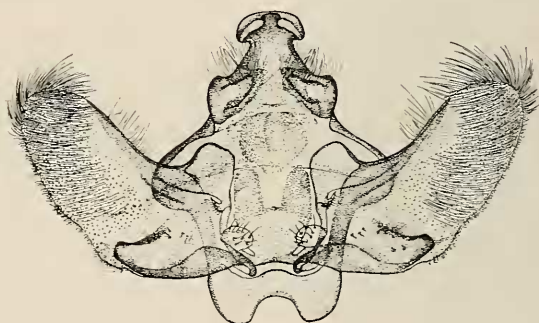
PLATE 13



4. *crumbi*



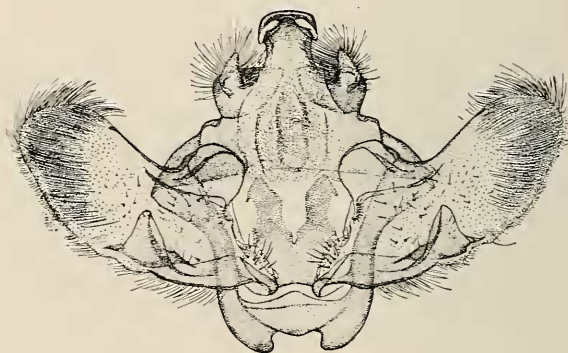
4^a



5. *improvisa*



5^a



6. *fasciata*



6^a

PLATE 14

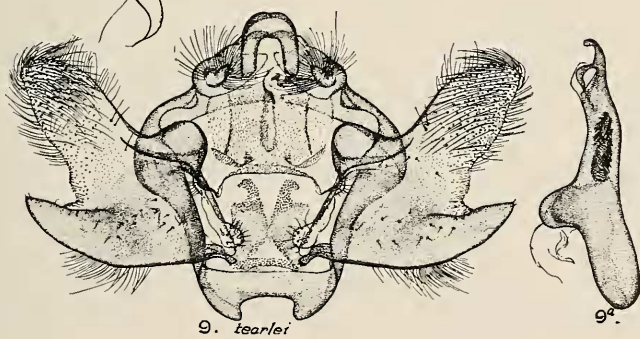
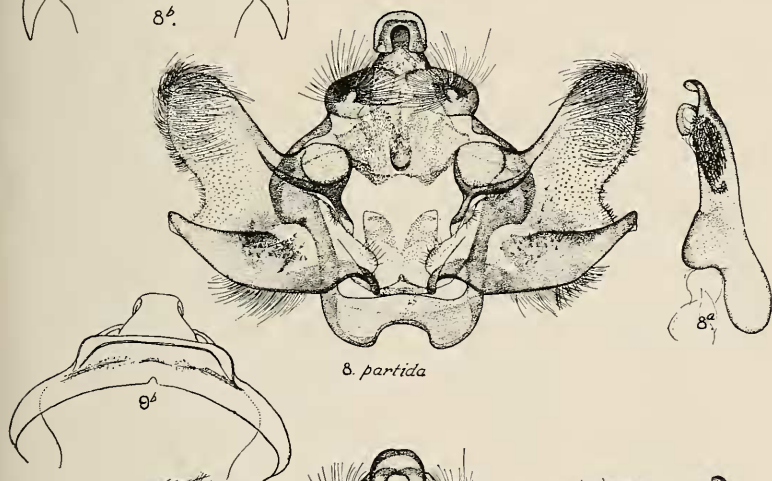
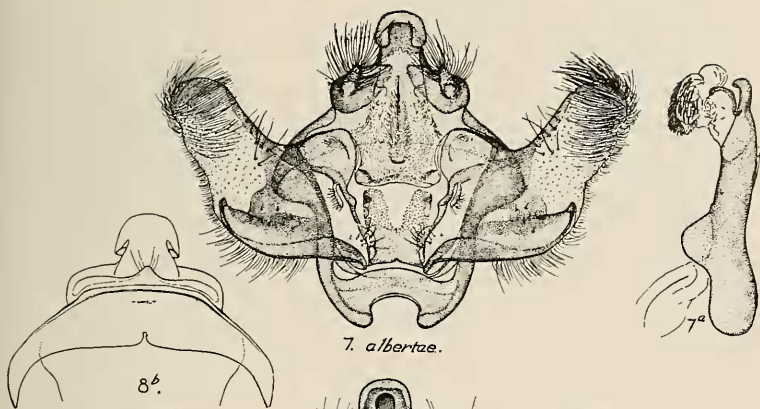


PLATE 15

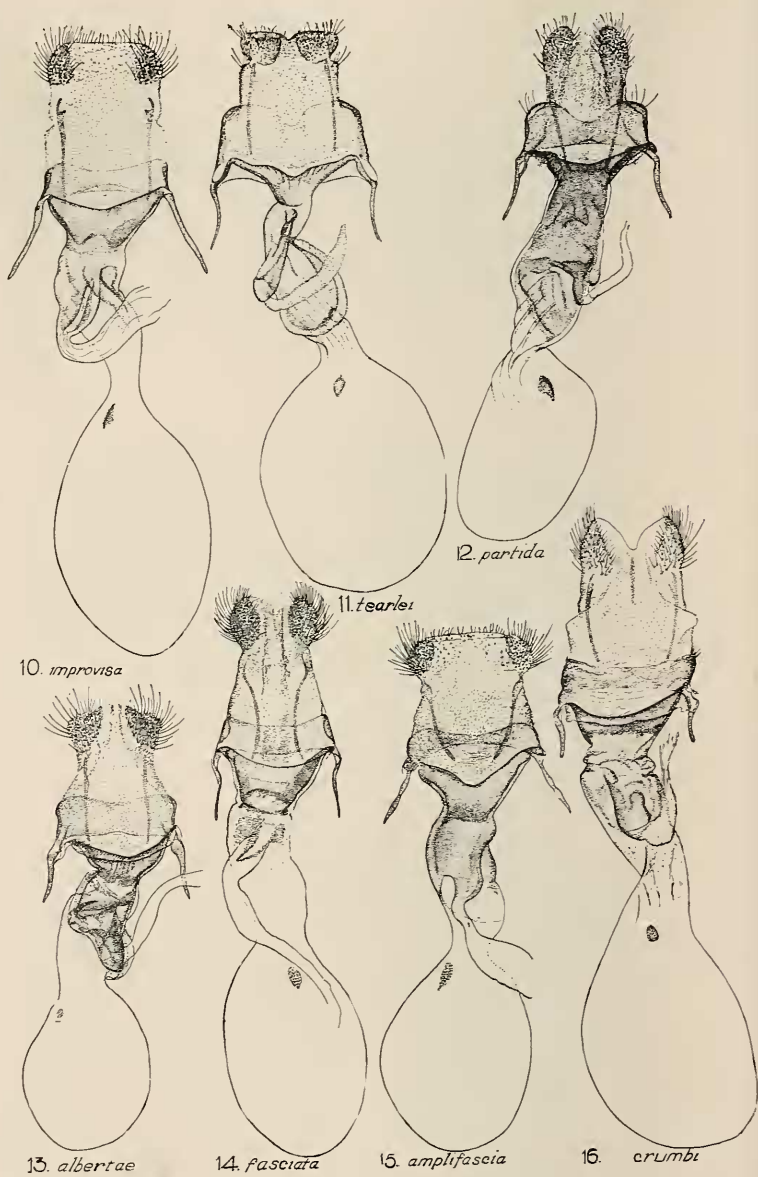
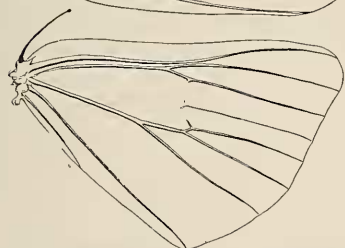
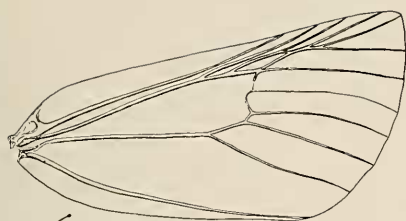
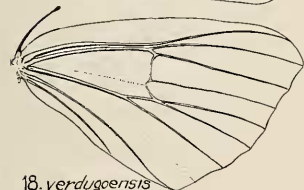
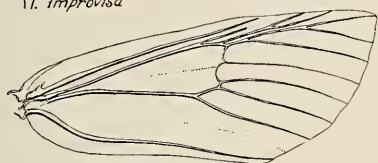


PLATE 16



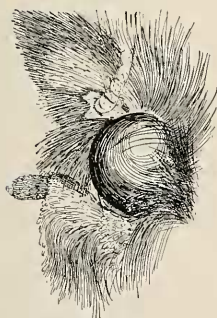
17. *improvisa*



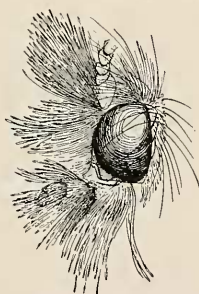
18. *verdugoensis*



19. *verdugoensis*



20. *improvisa*



21. *verdugoensis*

PLATE 17

THE LARVA AND CHRYSALIS OF ANCYLOXYPHA NUMITOR FABR.

By V. G. DETHIER

Biological Laboratories, Harvard University

The accurate description of the egg and first two larval instars of this common species by Scudder (1889) constitutes all that is known of its life history with the exception of a few sketchy notes, also by Scudder, on the terminal segments of a chrysalis collected by Harris.

The first instar larva measures from 1.3 to 2 mm. in length; the second instar larva, from 3 to 4 mm.

THIRD INSTAR

Length, 5 to 7 mm. Head width, .75 mm. Head length, .77 mm. Head shagreened, fuscous, with few scattered short transparent hairs. Ocelli, light fuscous. Mouthparts, dark brown. Dorsal thoracic shield, brown bordered anteriorly by a whitish band. General body color, straw to pale grass green finely mottled with greenish white. Mid-dorsal line not mottled hence appearing darker green than the remainder of the body. Legs and prolegs, pale yellow green. Body covered with many minute dark brown to black setae each arising from a similarly colored papilla. A paradorsal row of small yellowish plate-like setae one to each abdominal segment. Those on the thoracic segments are more subdorsal. The prothorax bears an additional suprastigmatal pair. Each segment not bearing abdominal legs has a subventral pair.

FOURTH INSTAR

Length, 8 to 10 mm. Head width, 1.0 mm. Head length, 1.1 mm. Little change in head and shield. Transparent hairs, shorter. Body similar to previous instar. Setae numerous and short, transparent to fuscous. Hairs from anal plate rather long and transparent. Plate-like setae on this segment conspicuous, yellow with dark brown rims.

FINAL INSTAR

Length, 18 mm. Head width, 1.8 to 2 mm. Head length, 2.2 mm. Head shagreened, with very few short hairs. Plate 18 A and B illustrates the distinctive dark brown and white head pattern of this instar. Ocelli, very light brown with a black circumferential ring. Mouthparts, dark brown to black. Dorsal thoracic shield, narrow, dark brown. Anterior edge of prothoracic segment pale yellow green. General body color, light grass

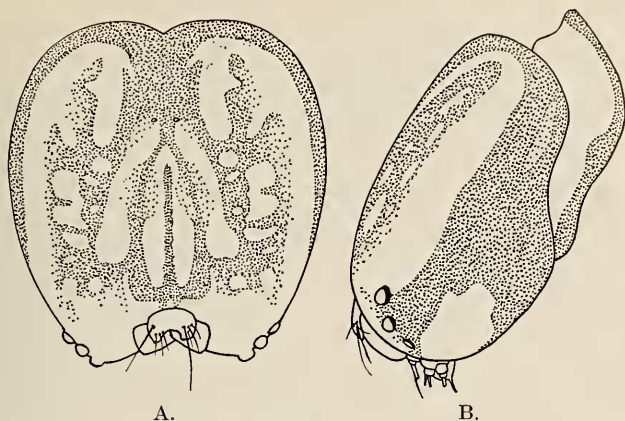


PLATE 18

Head of third instar larva of *Ancyloxypha numitor*, enlarged x 20.

A. Front aspect.

B. Lateral aspect.

green. Legs and prolegs, very light green to yellow. Body covered with short transparent setae arising from scattered papillae of the same color as the body. Prior to pupation the larva turned dead grass yellow and fell from its nest, coming to lie among the bases of the grass stems.

CHRYsalis

Length, 15 mm. General color, light cream. Anterior dorsal area, blue gray. Light brown markings as illustrated in Plate 19. The chrysalis differs from that as described by Scudder from Harris' fragment in the following respects:

Scudder's Description

reddish ashy color
sprinkled with brown dots
tubercles and bristles black
fuscous

Present Description

cream with brown markings
no dots
setae transparent, papillae
green

The descriptions agree in that the sides of the cremaster are deeply channeled and its inferior surface longitudinally combed. The ventral surface of the abdominal segments has exceedingly fine and weak transverse ridges. Harris (1862) described his specimen as being "—long, nearly cylindrical, but tapering at the hinder extremity, and with an obtusely rounded head."

The fragment of this specimen at the New England Museum of Natural History was carefully examined. Scudder's description is accurate, but the poor condition of the fragment renders a color description unreliable. The sprinkling of brown dots appears to be due entirely to the structure of the cuticle intensi-

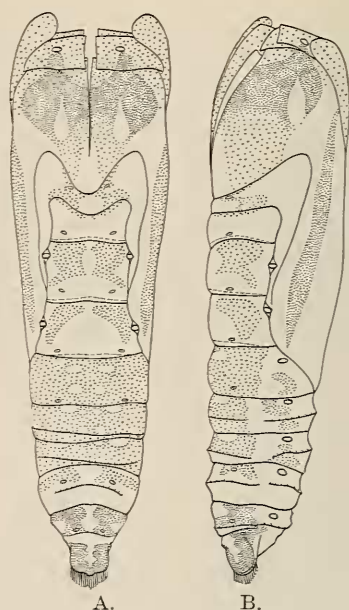


PLATE 19

Chrysalis of *Ancyloxypha numitor*, enlarged approximately x 4.

A. Dorsal aspect.

B. Lateral aspect.

fied by drying. Moreover, the dots occur only on a portion of the intersegmental membrane between the last two abdominal segments.

The final instar larva described above was collected from tall lush grass bordering a small brook which ran through an open field. It was procured May 21 by sweeping during the day. It fed by night on various types of grasses and rested by day in a case constructed from two blades of grass held together by silk threads. Pupation occurred May 31. A female emerged June 9.

According to Scudder the first brood of this species appears on the wing about the 10th or 12th of June in the vicinity of Boston. As this specimen emerged June 9, it is logical to suppose that it represented the first brood. Scudder also states that the eggs of the third and last brood hatch before the advent of winter. This being the case there can be no doubt that this species passes the winter in the larval state and not as a chrysalis as Scudder was inclined to believe. Hitherto the length of time passed in the pupal stage was unknown. Now it appears that the third brood spends nine days as chrysalids.

Immediately upon emergence the egg-filled female of brood one is ready to be fertilized. This particular specimen oviposited

June 14. The eggs of the first brood develop in from four to seven days, hatchings having occurred from June 18 to 21. The first instar is of four to six days' duration, moults occurring June 24; the second instar, four to seventeen days with moults June 28 and July 11; the third instar, nine to twenty-two days, moults occurring July 15 and 20. The last instar of this brood requires about twenty days.

When about to moult the larva retires to its nest where it becomes murky yellow and remains quiescent for two days. The prothorax becomes greatly distended. The skin ruptures along the anterior edge of the shield; the head capsule and integument loosen and are usually discarded simultaneously although frequently the former remains attached for several hours. Actual moulting requires but 60 seconds. The body is pale yellow; the head, dead white; the shield, brilliant white. After forty-five minutes all color has appeared. Usually the cast-off skin is eaten.

LITERATURE CITED

- Harris, T. W., 1862. A treatise on some of the insects injurious to vegetation. 3d ed., p. 308.
- Scudder, S. H., 1889. Butterflies of eastern United States and Canada. 2: 1560-1563.



A.



B.

PLATE 20

Larva and chrysalis of *Ancyloxypha numitor*, enlarged approximately x 3.

A. Dorsal aspect of mature larva. B. Ventral aspect of chrysalis.